

4D printing with acrylic-free sustainable resins

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ABSTRACT

The term 4D printing is related to 3D printed objects that can change shape over time. The process could be triggered by external stimuli¹ or, by a greater extent, to shape memory polymers². In this work it will be considered in particular stereolithography 3D printing. Stereolithography is a technique in which a liquid monomer is photo-polymerized to produce a solid object. Stereolithography allows to use different type of monomers and photoinitiators, that can be active under visible or UV light. Most of the active materials used as monomers now are widely available acrylates. Due to environmental and toxicity concerns related to their use, in this work we present natural-based non acrylic materials, like vegetable oil epoxides³. In particular, the epoxidized monomers can be used to create a multi-component photoinitiating mixture for stereolithography prints. The objects printed with this mixture can change their shape by the swelling related to water absorption under different environmental conditions. This phenomenon can be controlled by exploiting the osmosis. In fact, by varying the salt (NaCl) concentration of the water (where they are immersed), printed objects can change their shapes accordingly. The aim of this work was to exploit the stereolithography to create solid objects and to test their mechanical compressibility strength for future use as green actuators.

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